

REMARKS/ARGUMENTS

Reconsideration of this application is requested.

Enclosed in response to the final Office Action mailed on March 25, 2004 is a Request for Continued Examination. Also enclosed is a petition to extend by three months the period within which to respond to the final Office Action. As September 25 is a Saturday, the extended period for response expires on September 27, 2004.

Claim Status

Claims 1-2, 6-8 and 22-35 are pending in this application. The Action has withdrawn claims 31-35 from consideration on the grounds that they are directed to a non-elected invention. Accordingly, claims 31-35 are canceled. Claim 22 is amended for reasons of clarity. Accordingly, after entry of this amendment claims 1-2, 6-8 and 22-30 are pending.

Objections to the Specification

The abstract is objected to under MPEP 608.01(b) for not being in the range of 50-150 words. The specification is amended to include an abstract within this range. In particular, the abstract from the application as originally filed has been added. Accordingly, applicant submits that the objections to the specification should be withdrawn.

Claim Rejections - Claims 1-2, 6-8 and 22-25

Claims 1-2, 6-8 and 22-25 are rejected under 35 USC 103(a) as obvious over Carlson et al. (USP 5,421,957) in view of Laxman et al. (USP 5,874,368). Applicant again respectfully traverses these rejections.

As previously pointed out, none of the references of record teach or suggest the recitation of independent claims 1 and 22 of removing the silicon nitride formed in the reaction container before the silicon nitride reaches a thickness of 4,000 Å. Carlson only addresses unwanted silicon nitride films in a range of 1 to 5 micrometers (10,000-50,000 Å):

It has been observed that after a sufficient number of deposition processes, i.e. about 25~75 processes

for most materials, a film of sufficient thickness in the range between 1 to 5 micrometers builds up on the susceptor and the preheat ring.

(Carlson; column 4, lines 43-47)

The "Response to the Arguments" section of the final Action asserts that Carlson shows testing of films below 4000 angstroms in Table I. This assertion is not understood and is traversed. Table I does not include any disclosure of the thickness of the film that is being etched. Table I includes etch rates in angstroms/minute for various types of films, but these etch rates provide no information on the original thickness of the film. As Table I does not address the film thicknesses, there is no reason to suggest and certainly no disclosure that they are not within Carlson's previously discussed range of 1-5 micrometers.

The Action acknowledges that Carlson fails to show, as independent claims 1 and 22 require, forming the silicon nitride film from bis tertiary butyl amino silane (BTBAS) and NH₃, but asserts that this deficiency is provided by Laxman. In response, applicant submits that its recited thickness range is critical and produces unexpected results in the context of a silicon nitride film formed from BTBAS and NH₃. In particular, as described in the specification, silicon nitride films formed from BTBAS and NH₃, and having a thickness exceeding 4,000 angstroms, are susceptible to developing microcracks which, in turn, generate particles that can contaminate the semiconductor. Thus, generation of the particles is avoided by removing the films before they reach this thickness.

Carlson does not discuss the formation of silicon nitride film from BTBAS and NH₃, and hence cannot and does not appreciate the significance of removing the film before it reaches a significance of 4,000 angstroms. Laxman, while discussing the formation of silicon nitride film from BTBAS and NH₃, still does not comprehend or disclose the advantages of removing such film before it reaches a thickness of 4,000 angstroms. Hence, Carlson and Laxman, even when combined, do not render obvious claims 1-2, 6-8 and 22-25.

In support of its assertion that its claimed thickness range is critical and produces unexpected results, applicant submits herewith a Declaration of the inventors under 37 CFR 1.132. In particular, the Declaration states that silicon nitride films formed from BTBAS and NH₃ have a film contraction ratio of about nine times greater than film contraction ratios of silicon nitride films formed from other substances (SiH₂C₁₂(DCS) and NH₃) (Fig. 4), and a film stress of about two times greater than that of other such films (Fig. 5). Moreover, where cleaning (film removal) is carried out before the silicon nitride film reaches a thickness of 4,000 angstroms, particle generation is extremely suppressed (Fig. 7).

Neither Carlson nor Laxman teaches removal of a silicon nitride film formed from BTBAS and NH₃ before it reaches a thickness of 4000 angstroms. In view thereof, and further in view of the 1.132 Declaration regarding the unexpected results provide by such removal, applicant respectfully submits that claims 1-2, 6-8 and 22-25 are not obvious and that the rejection of these claims should be withdrawn.

Claim Rejections - Claims 26-30

Claims 26-30 are rejected under 35 USC 103(a) as obvious over Carlson and Laxman, and further in view of Nagashima et al. (USP 5,129,958). Nagashima is cited as disclosing the ammonia purge step recited in these claims.

Claim 26 depends from claim 22. Nagashima does not remedy the deficiencies of Carlson and Laxman as discussed above with respect to claim 22. Hence, claim 26 is allowable for the same reasons set forth with respect to claim 22.

Claim 27 is an independent claim requiring that purging of the reaction container using ammonia (NH₃) occurs after the object is carried into the reaction container. Nagashima, by contrast, introduces ammonia to purge the CVD chamber only when wafers and other objects that are to be film-formed are not present. Hence, applicant's claims require a purging operation while the object is present in the chamber, and Nagashima is directed only to purging while an object is not present in the container. In view thereof, applicant submits that claims 27, and

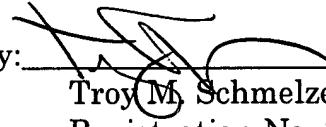
claims 28-30 dependent thereon, are not rendered obvious by Carlson, Laxman and Nagashima and that the rejection of these claims should be withdrawn.

Conclusion

In view of the foregoing, it is submitted that the application is in condition for allowance. The Examiner is urged to contact the undersigned at the telephone number listed below if any issues remain after entry of this amendment. Any fees due in connection with the filing of this response, including the fees due for a three month extension of time, may be charged to our Deposit Account No. 50-1314.

Respectfully submitted,
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